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COUNTY GOVERNMENT COMPUTER UTILIZATION AND APPLICATION IN FOUR NORTH CENTRAL STATES

by

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SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study was designed to determine the extent of computer utilization and specific applications to county government in the four North Central states of Iowa, Kansas, Michigan, and Missouri. The objectives were to:

(1) determine the extent of use and applications in the county governments of each state,

(2) delineate hardware and software problems encountered by county governments, and

(3) determine possible research areas which might be fruitful in helping county government improve data processing and decisionmaking management related to improve information systems.

The data base was acquired through a telephone survey with a questionnaire for all 401 counties in the state study group. Only one county refused to cooperate. Respondents were generally very cooperative and most indicated substantial interest in the study's results. Data acquisition by telephone appeared to obtain acceptably accurate results. In some technical areas such as processing languages or other technical information handling questions, non-data professional respondents were unsure of the answers to some questions. This was expected and was not regarded as a serious limitation in terms of the overall study. Some difficulty was also experienced in determining the actual level of functional application. It is believed that the results do provide a reason-

ably good overview of county government application of computer technology in the four-state study area. In general, the study should provide an acceptably accurate picture of the current state of computer use and some very useful information regarding problems and background for potential extension and research programs.

Earlier studies of local government information systems and computer technology have been classified into broad categories [Kraemer, et al.]. These are survey studies and prototype studies. Prototype studies have generally tended to be theoretical with emphasis on ideas rather than actual operations. An excellent example of an early prototype study of governmental data processing was done by Hearle and Mason in 1963 for the Rand Corporation. This study introduced the notion of a unified information system for state and local governments. The novel feature of this system was the conceptualization of a central record-keeping system on the basis of overall governmental use rather than on the basis of functional applications by individual office within government. This particular survey study and others done in the early 1970s indicate that the unified central data base concept is an idea whose time has not yet come for local governments.

Overview of the Findings

1. Since 1975, counties in the four states have moved considerably toward the use of computers in performing county governmental functions. Much variation existed between the four states in hardware, applications and use of private computer services both for data processing and software development.

2. By almost any measure, use of and interest in the use of computers is nearly universal among the counties in the four states. Only 5 to 10 percent of counties indicated no interest in computer-based information systems. These were mostly small counties with fewer than 10,000 people in 1980 and with assessed valuation of less than $25 million in 1976. Even in counties expressing no interest in computer-based information systems, the important problem was a lack of money rather than perceptions of impracticability of the technology. Only three or four respondents expressly viewed information technology as impractical under any circumstances for their counties.

3. In Iowa counties, 83 percent had computer hardware of some type, while only 28 percent of Kansas counties reported hardware in place. In Missouri counties, 68 percent had computer hardware and 51 percent of Michigan counties have internal systems of some type. It should be remembered that some of these machines were 10 years old or more and represented obsolete systems by current standards. Yet many counties with obsolete technology indicated plans for future updating as funds become available.

4. Use of computer services for county data processing varied greatly across the four states. Only one Iowa county reported reliance on outside data services for all data processing while 42 percent of all Michigan counties contracted their data processing to outside firms or government agencies. About 19 percent of Kansas' 105 counties reported contracting for data processing services but only slightly more than 5 percent of Missouri's 114 counties contracted for their data processing needs.

5. Only a relatively small percentage of counties in the four states still do all of their data processing manually. Approximately 10 percent of Michigan's counties still do all work manually while 54 percent of Kansas' counties process manually. Less than 30 percent of Missouri's counties and 16 percent of Iowa's counties report a manual data processing. These figures should be regarded only as the broadest measure of data processing development in the four-state region because it includes all counties that have even minor county government functions being done with aid of computers.

6. Seventeen brands of computers were in use by counties in the four states. In addition, each of the major brands had a large number of different models represented in the counties included in the survey.

Burroughs, IBM, and NCR were the "big three" in the county government computer market. Approximately 227 computers were in place in the four states and 195 of these or 86 percent were supplied by the "big three." The other 14 percent of the market was shared by the 15 other brands.

7. There was minimal cooperation between counties and other units of local government in the four states. Some sharing of software was noted by different Iowa counties but virtually no sharing of hardware was reported in any state. Most of the sharing of computers was between county and municipal governments sharing the same geographical jurisdiction. Almost 16 percent of Missouri's counties cooperated with municipalities in some manner in the use of their computers. Other states had

smaller percentages reporting such cooperation. Most of the rest of local government coperation was between counties and school districts. Over 8 percent of Michigan counties reported cooperation between counties and school districts in the use of computers.

8. Software availability and development of software appropriate for county government use appeared to be the single largest problem in shifting from manual to automatic data processing equipment. This problem is compounded by the large number of different brands and models in use by the different counties and by the lack of "off the shelf" financial packages that can be adapted or modified for county government use. Another compounding problem was the tendency of counties to each do things a little differently. This makes it very difficult for software suppliers to create software with general applicability. No brands in use by county governments are currently totally compatible with each other either in systems or application software. Even different models within brands are not necessarily compatible. IBM plug compatible manufacturers[1] did not appear to be currently in the computer market for county government systems in any counties in the four states.

9. Software was mainly from four sources. These were in-house developed, computer manufacturers or suppliers, private service firms, or a combination. Most of the combination uses were primarily in-house software

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[1]IBM plug compatibility includes a group of hardware manufacturers that will operate with system and applications software specific to IBM.

developments with a small amount of "off the shelf" application packages supplementing in-house development.

10. There appeared to be no clear-cut tendency for any specific source of software to prevail. Larger counties with their own data processing departments did tend to develop most of their software applications in-house. But even these counties did purchase "off the shelf" software. Burroughs provided the largest percentage of software to counties with Burroughs hardware, but even in this case private vendors were almost as important as suppliers of software to Burroughs users. In most cases private vendors supplying software to Burroughs users had at one time been employees of Burroughs. IBM was the only major vendor that was not active to any extent in supplying county governments with software. Most users of IBM equipment had in-house data processing professionals and tended to be in larger counties with $40 million or more in assessed valuation and 50,000 or more people.

11. Very few counties were fully automated by any measure and even the largest counties reported continuing development of their systems in terms of new and improved applications. Voter registration, extending and and billing of taxes, tax assessment, and payroll comprised the largest percentages of applications in counties in all states. Voter registration and payroll were usually the first applications attempted by a county making transition from manual to computer data processing. Tax work appeared to suffer the most from lack of standarized practices across counties even in the same state. This has created difficulty in development of application software for performing county tax functions.

12. The relationship between computer use and county size was examined in all four states using 1976 assessed valuation and 1980 county population as measures of county size. As expected large counties tended to use computers and smaller ones were less automated. However, the relationship was not perfect. Almost 100 percent of the counties with more than 50,000 people and over $50 million in assessed valuation either had their own computer or used a computer service for data processing. Only counties with less than 10,000 people and less than $10 million assessed valuation were still doing nearly 100 percent of data processing manually.

13. Cobol and RPG2 were the predominant computer languages in use by respondents that were knowledgeable on this subject.

14. Very small percentages of counties in all states were well into central unified data base systems. Most counties were still viewing data storage and processing on the conventional functional basis that was consistent with manual data systems.

15. Considerable numbers of professional data processors working for counties in all states expressed a desire to see more standardization of county government record systems both in the areas of tax-related data processing as well as in the internal financial accounting area.

16. A majority of respondents appeared to be pleased with their software and hardware. However, some dissatisfaction was expressed regarding software. A small number expressed concerns about hardware in place in their counties.

17. Most counties using a data processing service were reasonably pleased. Even so, the bias seemed to favor the purchase of their own computer as soon as possible. Just why such a bias existed in favor of their own in-house computer was not apparent from this study.

Areas of Potential Research

1. Some research which would involve continuous monitoring of counties concerning many of the data and attitude issues addressed in this study should probably be done on a yearly basis to provide a data base for research and general recommendations to counties experiencing data processing problems. The data developed in this study could be maintained and updated by each state with fairly minimal cost in time and money.

2. Although minimal cooperation between units of local governments has been achieved up to the date of this study, the development of research that addressed the issues impeding local intergovernmental cooperation in use of computers would appear to be a very fruitful area of future research. Both Hillsdale County, Mighigan, and Franklin County, Missouri, have provided evidence of very successful local government cooperation in the use of a central computer. Preliminary evidence would indicate reduced costs and improved efficiency. Potential costs and benefits of such systems should be looked at in a detailed case study which would have as a major objective the determination of guidelines for other units of local government which might desire to try to follow the examples set by these two counties and other units of local government involved.

3. The current state of computer technology and even more so, that which will be available by 1985, would allow much more local intergovernmental cooperation between cities, counties, hospitals, school districts, townships, and other units of local government and perhaps even the state and possibly interstate cooperation. Obviously little is known at this time about costs and benefits that would accrue from more cooperation. But given the potential of the state of the arts of distributed data processing system which allow even very distant entities to use a central computer both for information storage and processing, an investigation to barriers impeding cooperation of units would appear to be a fruitful area for future research.

4. Some impressions gleaned from this study would suggest that county decisionmakers have a bias toward owning their own computers. There may be a good reason for this. However, it may also be without much more justification that the traditional feeling of maintaining hands on contact with their own records. It would be easy to see why this attitude would prevail yet it could be a major factor in impeding the realization of the full potential of modern information technology in county government operations. At any rate a cost-benefit type of analysis of a county owning its own computer versus hiring its data processing done by a service would appear to be another fruitful area of research exploration. Political and access impediments to the use of computer services also need to be explored in such a study.

5. The whole issue of software development for county government use is obviously a problem area which merits investigation. The biggest problem now, which impedes general application software development, centers on the large number of competing brands now in service which are incompatible with respect to both system and application software. Some way around the limitation imposed may be found by research but right at the moment a solution is not immediately apparent. Certainly recognition of the technical problem and implications for applications to data processing functions by potential computer purchasers might well be the best solution over time. This could result in pressure on manufacturers to create more compatible machines. Obviously this is possible because a whole segment of the computer industry has grown up in recent years to produce IBM plug compatibles. These machines are compatible with IBM models both in terms of systems as well as applications software. Also more sharing or intergovernment cooperation in the use of the hardware might reduce the problem of machine incompatibility simply by reducing the number of different models and brands in use.

It might also be argued that the lack of easy to use "off the shelf" applications software packages specifically tailored to county government and specific to a few brands and models is a contributing factor in the brand and proliferation observed in this study. Obviously, this is a "chicken and egg" issue but development of easy locally adapted software available to counties and usable on specified hardware could reduce the problem. At any rate, the current state of the market is not resolving the problems. This is an area that deserved further research.

6. This study indicated that most counties still view information storage and county government record keeping in the traditional county office function context. Yet from a theoretical standpoint, Hearle and Mason [1963] made a convincing case for the unified information system. Logically, a unified data system would eliminate overlapping in the collection and storage of data and provide better information for management decision-making. Some counties appear to have made good starts in the direction of unified record keeping systems.

A study of costs and benefits of the unified approach as compared to the more traditional approach would appear to be possible. This assumes that some county or counties that have tried to unify their record system would be willing to participate in a case study. An objective of such a study should include a system analysis of the whole process to see whether further improvements that would have general applications could be made. Such a study would also include any analysis of the relation between different units of local government and data requirements. Hearle and Mason argue that many units of local government, particularly cities and counties actually use much of the same data. Undoubtedly much difficulty would be encountered in convincing officials that cooperation could be fruitful in use of common data bases. If efficiencies could be shown to exist, it would be a starting point. The impact of a unified system in improving local government management decisions also could be explored in such a study.

7. More information is needed concerning software development firms, software development by computer manufacturers and in-house development of software for county government use. There would appear to be inadequate communication between county governments regarding applications software currently available for county government use. Such an information base developed and maintained would appear to be needed. This may be more of an extension function than a research function. Probably some of both would be involved.

8. More information needs to be assimilated regarding hardware in use by county government that would provide information helpful in deciding particular brands and model best suited to the needs of local government. Much of this information is currently available in current trade publications but probably would not be accessible to decisionmakers in county governments or not in a form that could be used.

INTRODUCTION

Computer technology has been developing at an accelerated pace during the last two decades. Applications of computer technology in both the public and private sectors of the U.S. economy have slowed the development of computer technology both in the use of hardware and software. Researchers have estimated that a lag of 10 to 15 years exists between the development of computer technology and its adoption at the local government level [Kramer, Danziger, and King, 1978].

Such research suggests a major gap between what could be in terms of computer applications at the county government level and what is actually done, even if what could be might not necessarily be what ought to be. This is a report of a study of computer applications in the county governments of the four states of Iowa, Kansas, Michigan, and Missouri. The objectives of the study were to:

(1) determine the extent of current computer applications in the counties of the four states,

(2) delineate problems encountered by local governments in use of hardware and software, and

(3) determine possible areas of reasearch that might help to improve the use of computers by local governments in the future.

Information regarding the use of computers by the counties included in this survey was collected by a telephone survey of the 401 counties in four states during the months of March, April, and May of 1982. All counties

were contacted in the telephone survey and 400 out of the 401 counties co-operated in the survey. Thus, the results of the study appears to represent a reasonably accurate picture of the actual state of computer use and application by counties in the four-state region.

COUNTY DATA PROCESSING HARDWARE IN THE FOUR STATES

Much variation existed among the four states regarding the percentages of counties with some kind of automatic data processing equipment. Eighty-three percent of Iowa counties had computer hardware of some type, while 68 percent of Missouri counties had such equipment (Table 1). Almost 50 percent of Michigan counties had some kind of computer, while only 27 percent of Kansas counties had computers (Table 1).

One of the more important questions regarding county computer equipment concerns the brands and models currently in use. This is true because of the lack of equipment standardization with respect to both systems software and applications software. Currently, different brands of computers are generally incompatible with most cases other than so-called IBM plug compatible equipment or plus compatible manufacturers (PCM) equipment as it is called in the jargon of computer trade publications. PCM equipment is, specifically, designed by manufacturers to run on specific systems and applications software designed for specific IBM models. However, no PCM equipment was found to be currently in place in county governments included in this four-state survey.

Seventeen different computer brands were currently in place in different counties in the four states (Table 2). Based on the technical state of the arts in applications and systems software development, creating general applications software for county government functions

Table 1. Computer in county government in the four states

State	No. of computers	Percent	No. without computers	Percent	Total counties
Iowa	82	83.0	17	17.0	99
Kansas	28	26.7	77	73.3	105
Michigan	40	48.2	43	51.8	83
Missouri	77	67.5	37	32.5	114
	227				401

across counties within states would be fairly difficult. Given variation in functional procedures between states, development of general county government applications software across states becomes even more of a complex task. This is not to say that a thrust in the direction of standardization of application is impossible under current conditions. It is only to say that it is greatly complicated by the current state of the art both with respect to brand and model configurations within county government.

Notwithstanding the lack of standardization, three manufacturers -- IBM, NCR, and Burroughs -- accounted for the majority of hardware in place in county governments in all four states. Burroughs had nearly 54 percent of county computers in Iowa and over 53 percent in Missouri, while accounting for almost 40 percent in Kansas and 45 percent in Michigan.

Table 2. Computer brands in county government in the four states

Brand	Iowa		Kansas		Michigan		Missouri	
	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
Burroughs	44	53.7	11	39.3	18	45.0	41	53.3
Data General	3	3.7	0	0.0	1	2.5	1	1.3
Datapoint	1	1.2	0	0.0	0	0.0	1	1.3
DEC	1	1.2	0	0.0	0	0.0	0	0.0
Hewlett Packard	1	1.2	0	0.0	1	2.5	1	1.3
IBM	21	25.6	11	39.3	13	32.5	9	11.7
Monroe	1	1.2	0	0.0	0	0.0	0	0.0
NCR	6	7.3	4	14.3	3	7.5	16	20.8
Quantel	3	3.7	0	0.0	0	0.0	0	0.0
Texas Instrument	1	1.2	0	0.0	0	0.0	2	2.6
Radio Shack	0	0.0	1	3.6	1	2.5	1	1.3
Randal	0	0.0	1	3.6	0	0.0	1	1.3
Honeywell	0	0.0	0	0.0	1	2.5	1	1.3
Lears Seigler	0	0.0	0	0.0	1	2.5	0	0.0
Sperry Univac	0	0.0	0	0.0	1	2.5	1	1.3
Olivetti	0	0.0	0	0.0	0	0.0	1	1.3
Prime	0	0.0	0	0.0	0	0.0	1	1.3
	82	100.0	28	100.0	40	100.0	77	100.0

The four states had 227 computers in place in the 401 counties or 56.6 of the total. The three major hardware vendors (Burroughs, IBM, and NCR) accounted for 195 of the 227 total with Burroughs alone supplying 114 computers or approximately one-half of the total.

Each of these major hardware vendors had many different models represented in the four states. Burroughs alone had 15 different models (Table 3). IBM supplied 13 models and NCR 14 models (Tables 4 and 5).

Local Government Cooperation in Use of Computers

Minimal cooperation in use of computers between counties and other units of local government was found in the four-state study. When cooperation did exist, it was mostly between counties and the municipal government within that jurisdiction and was restricted to county computer tax billing for a municipal government.

Exceptions to this were Franklin County, Missouri, and Hillsdale County, Michigan. In these counties, a centrally located computer is shared by a number of units of local government including counties, municipalities, school districts, and townships. A more detailed description of the experiment with local cooperation in use of computers in Franklin County, Missouri, is available [Kerr, et al., 1981]. Both these cases of broad intergovernmental use of a central computer appear to have been a result of a major input from agencies not internal to the local

Table 3. Models of Burroughs equipment in use in the four states

State	1155	18515	2890	1860	3700	3890	80	700	800	900	92	93	920	LX000*	6800	Total
Iowa	0	2	0	1	0	1	2	0	14	7	1	10	1	15	0	44
Kansas	1	0	0	0	0	0	0	0	0	2	0	1	0	7	0	11
Michigan	2	1	1	0	1	0	0	2	3	0	0	0	0	7	1	18
Missouri	0	0	0	0	0	0	2	0	2	0	0	0	0	32	0	41
																114

*Includes all Burroughs L Series Model

Table 4. Models of IBM equipment in use in the four states

	Model													
State	370	4341	Ser.1	32	Ser.3	34	5156	3033	38	3300	3031	4331	5110	Total
Iowa	0	1	0	1	0	16	0	1	0	1	0	0	0	20
Kansas	0	2	1	0	0	2	1	0	0	0	1	1	2	10
Michigan	0	2	0	1	2	7	0	0	0	0	0	1	0	13
Missouri	2	0	2	0	1	3	0	0	1	0	0	0	0	9
														52

Table 5. Models of NCR equipment in use in the four states

	Model												
State	9010	399	499	8200	8270	8435	9020 & 9040	8100	8271	8455	8130	8150	Total
Iowa	0	1	1	1	1	1	1	0	0	0	0	0	6
Kansas	0	0	0	1	0	0	2	0	1	0	0	0	4
Michigan	0	0	2	0	0	0	0	0	0	1	0	0	3
Missouri	1	4	3	2	0	0	2	1	0	0	1	2	16
													29

governments themselves. In both cases, a coordinating force from University Extension personnel appears to have provided the initial thrust toward local government computer sharing of a central computer.

Most cooperation between units of local government in the four states was between counties and municipalities. Missouri led in local government cooperation with 20 counties reporting some cooperation with other units or approximately 17 percent of the counties (Table 6). Michigan was the only state reporting substantial cooperation between counties and school districts (Table 6). In general, intergovernmental cooperation was minimal in the four states. The success of carefully monitored cases such as Franklin County, Missouri, and Hillsdale County, Michigan, suggests that University Extension might find a major role in serving as a catalytic force for more of such activity.

Another aspect of intergovernmental cooperation, which was investigated, was with county government sharing and cooperation in use of software and hardware. County government sharing of software and hardware was very minimal in the four states (Table 7). Only Iowa reported a substantial number or counties sharing software (Table 7). The Iowa experience can apparently be attributed to the existence of a county computer users association known as ICUBE (Iowa County Users of Burroughs Equipment) and to a state law requiring the sharing of county government software developments.

Table 6. Cooperation of counties in computer use with other units of government in the four states

State	Cooperating unit					
	Municipal		School district		Other	
	Number	Percent of total counties	Number	Percent of total counties	Number	Percent of total counties
Iowa	8	8.0	0	0.0	0	0.0
Kansas	5	4.8	0	0.0	0	0.0
Michigan	6	7.2	7	8.4	0	0.0
Missouri	18	15.8	< 1	< 1.0	1	< 1.0

Table 7. Counties sharing or leasing of computer software or hardware with other counties or units of government in the four states

State	Software		Hardware	
	Number of counties	Percent of total	Number of counties	Percent of total
Iowa	14	14.1	1	1.0
Kansas	2	2.0	0	0.0
Michigan	0	0.0	1	1.0
Missouri	3	2.6	3	2.6

Table 8. Use of private computer services for county government function in the four states

State	Number of counties	Percent of total counties
Iowa	1	1.0
Kansas	20	19.0
Michigan	35	42.2
Missouri	6	5.3

Very little sharing of hardware was noted in counties in the four states. Most of the minimal sharing in Missouri and other states was confined to voter registration activities.

Uses of Private Computer Services

One option available to county governments in the four states was the use of private computer services for data processing functions. These private services usually contract with county government for performance of certain data processing functions. The service supplier will furnish varying levels of both software and hardware depending upon the organization of the particular firm. These firms were not included in the survey so details are not available regarding variations in existing operations. However, in most cases counties apparently supply firm with data to be processed in a previously arranged form. The contracting firm then processes the data using its own software and hardware.

Use of a private computer service by county governments varied considerably between the four states (Table 8). Michigan had by far the largest number and percentage of its counties using private data processing services among the four states (Table 8). Iowa had only one county using a private firm for all county data processing. The sum of Column 2 in Table 8 and Column 2 in Table 1 gives an overall indication of the extent of the move toward data processing automation in the counties of the four states. This computation indicates that 84 percent of Iowa counties have either their own computers or rent data processing from a private

firm. Only 16 percent of Iowa counties still do their data processing manually. Approximately 46 percent of Kansas counties, 90 percent of Michigan counties, and 73 percent of Missouri counties either have computers or rent data processing services from private firms. These numbers can only be regarded as the broadest kind of measure in evaluating the move of county governments in the four states to automatic data processing. These figures include any county that does not still do all functions manually. In many cases only one function, such as voter registration, payroll, or tax billing, may have been automated in any particular case. This question of the extent of functional automation will be addressed in a later section.

Technology of County Government Computers in the Four States

The rapid development of new computer technology with the concomitant obsolescence of older equipment is well recognized by anyone vaguely familiar with the area. Some effort was made in this study to determine the level of technology currently in place in the four states' counties. This determination was restricted primarily to input-output and storage devices. Limitations on the extent of the study of technical questions were necessary because many of the respondents were county government officials and were not familiar with the technical details of computer technology. A large portion of computers in use by county governments in the four states had the latest CRT input-output technology (Table 9).

Yet a substantial number of counties were still using cars as major data storage devices. As was indicated earlier, many counties in all four states were still using some model of the Burroughs L series, all of which are regarded as somewhat dated in terms of current technology. Yet these machines will perform many county data procesing functions, and a number of persons indicated that even the older technology was not being used to extent possible because of programming limitation.

Although data collected in the study was minimal regarding the extent and scope of technical updating of hardware, the general impression was that most counties were very concerned with having the latest in hardware technology. This seemed to be true even by some admitting that existing hardware was being less than fully utilized in terms of its capacity.

Software Development and Supply Sources of County Government in the Four States

Probably the most important concern of any computer application is the availability of appropriate software needed for purposes of enabling the computer to perform specific jobs or functions. Software availability for specific county government applications appears to be by far the most important problem facing county government after a decision is made to automate a particular county function. A major part of this study was to determine availability, sources, and methods of procuring computer software to perform county government functions. Sources of software for

Table 9. Technical features of computers in counties in the four states

	Data Storage Devices											
	Input-Output CRT		Cards		Tape		Floppy disc		Hard disc		Combination	
State	No.	Percent of total	No.	Percent of total	No.	Percent of total	No.	Percent of total	No.	Percent of total	No.	Percent of total
Iowa	64	77.0	14	16.8	4	4.8	1	1.2	61	73.5	3	3.6
Kansas	20	71.4	7	25.0	0	0.0	1	3.5	20	71.4	0	0.0
Michigan	34	85.0	8	20.0	0	0.0	0	0.0	32	80.0	0	0.0
Missouri	40	52.0	32	41.5	8	10.4	5	7.0	32	41.6	0	0.0

Table 10. Source of computer software for county government applications in the four states

	In-house development		Computer vendor		Private service firm		Combination	
State	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
Iowa	13	15.8	21	25.6	32	39.0	6	19.5
Kansas	7	25.0	5	17.9	11	39.0	5	17.9
Michigan	17	42.5	6	15.0	3	7.5	14	35.0
Missouri	21	27.3	30	39.0	23	29.9	3	3.9
Average		27.65		24.4		28.8		19.1

county government applications included in house-development, computer vendor or manufacturer, private software service firm, or some combination of these. Combinations reported were always in-house development supplemented by some "off the shelf" packages. In most cases the "off the shelf" package was purchased by a county for some specific application. These packages were supplied by particular service firms.

County governments in all four states used all of the sources of computer software (Table 10). There appeared to be no strong tendency for any particular source of software to prevail over the other sources of software. Percentages of counties reporting all in-house software development ranged from 42.5 percent in Michigan to 15.8 percent in Iowa. Iowa, Kansas, and Missouri counties also relied heavily on private service firms for software (Table 10).

Tables 11, 12, and 13 summarize the distribution of percentages of various types of software utilization among the counties in the four states. The major point made by these three tables is that a large portion of counties in all four states used some software from all of the sources. There were a few tendencies that can be noted in regard to percentage distribution of use of software from the different sources. None of Iowa's counties reported all of their software as developed in-house. However, 42.5 percent of Michigan's counties with their own computers reported all software developed in-house, yet 27.5 percent of Michigan counties reported no in-house software development (Table 11).

Counties using private service vendors for software reported a maximum of 50 percent of their software as so supplied (Table 12). Private vendor supplied software appeared to be the least important source of computer software for the counties in the four states.

Hardware supplier software appeared to be the most important source of county government computer software in the four states when viewed from the standpoint of the percentage distribution of development (Tables 11, 12 and 13). But even here, Kansas reported 82 percent of its counties with computers using no manufacturers supplied software.

Another aspect of software development evaluated was the relation of the major brands of Burroughs, IBM, and NCR to the type of software utilized by counties. During the interviewing phase, the impression given by counties with Burroughs equipment was that Burroughs did most of the software for users of their equipment. A tabulation of the data revealed that Burroughs did supply the largest percentage of software for users of their equipment (Table 14). However, private service vendors were also a major force in the software applications of users of Burroughs equipment (Table 14). In many cases private vendors of software specific to Burroughs equipment were originally employees of Burroughs, but had elected to go private as their software development skills for county government applications materialized. The exact amount of this shift from company to private service firms was not tabulated because its importance was not recognized early enough in the study. Yet,

Table 11. Percentage of in-house software developed by county governments in the four states

State	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
	0		30		40		50		75	
Iowa	33	40.2	34	41.5	1	1.2	14	17.1	0	0.0
Kansas	17	63.0	0	0.0	0	0.0	1	3.7	0	0.0
Michigan	11	27.5	0	0.0	0	0.0	8	20.0	0	0.0
Missouri	52	74.0	0	0.0	0	0.0	0	0.0	1	1.3
	80		90		95		99		100	
Iowa	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0
Kansas	4	14.8	0	0.0	0	0.0	0	0.0	5	18.5
Michigan	2	5.0	0	0.0	1	2.5	1	2.5	17	42.5
Missouri	0	0.0	2	2.6	0	0.0	0	0.0	17	22.0

Table 12. Percentage of private vendor supplied software used by county governments in the four states

	0		10		15		20		40		50	
State	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Iowa	33	40.2	34	41.5	0	0	0	0.0	1	1.2	14	17.1
Kansas	12	42.9	11	39.3	0	0	4	14.3	0	0.0	1	3.6
Michigan	26	65.0	3	7.1	0	0	2	4.8	0	0.0	9	21.4
Missouri	56	72.7	21	13.0	0	0	0	0.0	0	0.0	0	0

Table 13. Percentage of hardware supplier software used by county governments in the four states

	0		10		25		30		50		100	
State	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Iowa	56	68.3	0	0.0	0	0.0	1	1.2	2	2.4	23	28.0
Kansas	23	82.1	0	0.0	0	0.0	0	0.0	0	0.0	5	17.8
Michigan	31	77.5	0	0.0	0	0.0	0	0.0	2	5.0	7	17.5
Missouri	37	48.0	1	1.3	1	1.3	0	0.0	0	0.0	38	49.4

Table 14. Software utilized by county governments in the four states with Burroughs equipment

	In-house development		Computer vendor		Private service firm		Combination	
State	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of Total
Iowa	4	9.1	17	38.7	19	43.2	4	9.1
Kansas	3	27.3	4	36.4	4	36.4	0	0.0
Michigan	4	22.2	5	27.8	2	11.1	7	38.9
Missouri	12	27.3	17	38.6	11	25.0	0	0.0
Average		21.5		35.4		28.9		12.0

it is obviously an important part of the market for Burroughs equipment in county government applications. The importance of manufacturers supplied and private service vendor supplied software related to the manufacturers appeared to be a major factor in the success of Burroughs equipment in capturing the major part of the county government computer hardware market in the four states.

During the interview phase of the study, the impression was formed that most county government users of IBM equipment were larger counties that could afford in-house programming personnel for software application development. This impression was also verified by the investigator in an informal interview with IBM representatives in IBM offices in Columbia, Missouri, and Jefferson City, Missouri. IBM representatives indicated that the market was not sufficient in their judgment to justify a large effort on their part to develop applications software specifically for county government. From the viewpoint of these representatives, a lack of standardization of procedures across counties within states as well as lack of standardization by states, particularly in relation to methods of handling taxation, precluded feasibility of development of software applications packages specific to county government. The tabulated results of this study support these impressions (Table 15). Very little IBM developed software was utilized by counties in any of the four states using IBM equipment (Table 15).

Private service firms were the most important suppliers of software for those counties in the four states using NCR equipment (Table 16). Missouri counties using NCR equipment provided an exception, with almost 69 percent of NCR users receiving their software from NCR (Table 16).

Functional Application of Data Processing by County Governments in the Four States

One of the most important questions and yet one of the most difficult to address in a telephone survey is the actual level of functional applications of automatic data processing equipment in county government. Much variation existed between the states in terms of individual functional applications as well as between functional applications within states (Tables 17, 18 and 19).

Major functions of county government that were classified in the study were voter registration, tax extending and billing, payroll, budgeting, accounts payable, accounts receivable, financial reporting, and miscellaneous functions. Miscellaneous functions included special activities that were peculiar to a local situation. An example was drainage district functions in substantial numbers of Iowa counties.

Tax work and payroll were the most automated functions of county government given the number of counties with computers and computer services (Table 17). Substantial automation of voter registration has occurred in the four states. Other activities studied have been automated, to some extent by county governments in the four states, but large per-

Table 15. Software utilized by county governments in the four states with IBM equipment

State	In-house development		Computer vendor		Private service firm		Combination	
	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
Iowa	7	33.3	1	4.8	4	19.0	9	42.8
Kansas	1	12.5	0	0.0	4	50.0	3	37.5
Michigan	9	69.2	0	0.0	1	7.6	3	23.1
Missouri	4	50.0	1	12.5	1	12.5	2	25.0
Average		41.2		4.3		22.3		23.6

Table 16. Software utilized by county governments in the four states with NCR equipment

State	In-house development		Computer vendor		Private service firm		Combination	
	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
Iowa	1	16.7	0	0.0	4	66.7	1	16.7
Kansas	1	25.0	1	25.0	2	50.0	0	0.0
Michigan	1	33.3	0	0.0	2	66.7	0	0.0
Missouri	1	6.2	11	68.8	4	25.0	0	0.0
Average		20.3		23.4		52.1		4.2

centages of counties with computers are still a long way from having all county functions computerized.

An effort was also made to determine accessibility and use by particular county offices. The results of this effort was summarized in Tables 18 and 19. The collector, assessor, and county clerk appeared to have access to and did utilize the computer with a greater frequency than other county offices. The recorder offices were conspicuous in terms of lack of access to and use of computers. In general, recorders only in large counties were making full use of the computers for data storage and processing. This study provides no insights as to why recorders have access to and utilize the computers less frequently than the other major offices of collector, assessor, and county clerk. Treasurers appeared to have better access to and use of computers than recorders but less use and access than the three major users (Tables 18 and 19). In general, lack of appropriate software to perform specific functions appeared to be the major roadblock to fuller utilization of county government computer capabilities in the four states.

Computers in Relation to County Size in the Four States

Two measures of county size were used to establish whether and what relation might exist between computer availability and use and also use of computer services by counties in the four states. These were the assessed valuation in 1976 and the county population in 1980. Tabulations

Table 17. Functional applications by county governments in the four states

State	Number	Percent of total counties	Number	Percent of total counties	Number	Percent of total counties	Number	Percent of total counties
	Voter registration		Tax extending and billing		Payroll		Budgeting	
Iowa	29	29.3	74	74.8	71	71.7	37	37.4
Kansas	31	29.5	37	35.3	26	24.8	7	6.7
Michigan	22	26.5	50	60.3	61	25.0	61	30.1
Missouri	15	13.2	43	37.7	29	25.4	8	7.0
	Accounts payable		Accounts receivable		Financial reports		Miscellaneous activities	
Iowa	21	21.2	18	18.2	22	22.2	21	21.2
Kansas	6	5.7	5	4.7	5	4.8	7	6.7
Michigan	24	28.9	14	16.9	22	26.5	5	6.0
Missouri	9	7.9	6	5.3	8	7.0	0	0.0

Table 18. Computer use and access by different county offices in the four states

State	No.	Percent of total counties	No.	Percent of total counties	No.	Percent of total counties	No.	Percent of total counties	No.	Percent of total counties
	Collector		Assessor		County clerk		Recorder		Auditor	
Iowa	72	72.7	72	72.7	72	72.7	14	14.1	71	71.7
Kansas	15	14.3	11	10.5	14	13.3	1	< 1.0	4	3.8
Michigan	26	31.3	20	24.1	36	43.4	3	3.6	0	0.0
Missouri	50	43.9	42	36.8	38	33.3	9	7.9	8	7.0
	Treasurer		County administrator		Sheriff		Circuit court		Road department	
Iowa	55	55.6	4	4.0	15	15.1	4	4.0	2	2.0
Kansas	18	17.1	0	0.0	6	5.7	0	0.0	0	0.0
Michigan	33	39.8	0	0.0	9	10.8	0	0.0	0	0.0
Missouri	13	11.4	6	5.2	7	6.1	6	5.3	1	< 1.0

Table 19. Relation of assessed valuation and computers in Iowa counties

Assessed valuation (millions of dollars)	Number of counties	Number of computers	Percent of total
0-150	9	2	22.2
151-200	6	5	83.3
201-250	10	8	80.0
251-300	15	13	86.7
301-350	13	11	84.6
351-400	15	14	93.3
401-450	7	6	85.7
451-500	4	4	100.0
501-550	3	3	100.0
551-600	3	3	100.0
Over 600	14	13	

reported in the tables of this section were only for counties with their own equipment. Those using computer services were excluded from the tables to avoid confusion. One large Iowa county (assessed valuation over $600 million) relied entirely on a private computer service for data processing.

The data were evaluated by states and because of major differences between states particularly in county assessed valuation, an interstate comparison did not appear particularly useful. A very large majority of Iowa counties with assessed valuation of over $150 million had computers to perform major data processing functions (Table 20) yet only 22 percent of those counties with less than $150 million in assessed valuation had computers.

All Kansas counties with assessed valuation of more than $150 million had computers (Table 21). Almost 9 percent of Kansas counties with assessed valuation up to $50 million had computers (Table 21).

Table 20. Relation of assessed valuation and computers in Kansas counties

Assessed valuation (millions of dollars)	Number of counties	Number of computers	Percent of total
0-50	58	5	8.6
51-100	28	12	42.9
101-150	11	6	54.5
Over 150	5	5	100.0

Table 21. Relation of assessed valuation and computers in Michigan counties

Assessed valuation (millions of dollars)	Number of counties	Number of computers	Percent of total
0-50	3	0	0.0
51-100	13	3	23.1
101-150	12	2	14.5
151-200	14	5	35.7
201-250	7	4	57.1
251-300	5	2	40.0
301-350	5	4	80.0
Over 350	19	17	89.5

Michigan counties showed the same general pattern of computer hardware in place in relation to county assessed valuation as Iowa and Kansas counties (Table 22). However, several Michigan counties in all assessed valuation categories used computer services, in lieu of having their own computers. This reduced Michigan percentages of total counties with their own computer hardware relative to other states.

It was necessary to create smaller class intervals for assessed valuation per counties for Missouri counties with valuation below $50 million in order to make an analysis of the relation of computer hardware in place relative to assessed valuation. In 1976, only one Missouri county had an assessed valuation of less than $10 million and it did not have a computer in 1982. Yet 33 percent of Missouri counties with assessed valuation of between $10 million and $20 million had some kind of computer hardware of their own in place in 1982 (Table 2 and 3). For increments

Table 22. Relation of assessed valuation and computers in Missouri counties

Assessed valuation (millions of dollars)	Number of counties	Number of computers	Percent of total
0-10	1	0	0.0
11-20	9	3	33.3
21-30	18	7	38.9
31-40	25	16	64.0
41-50	13	11	84.6
51-100	32	28	87.5
101-150	3	1	33.3
151-200	6	6	100.0
Over 200	7	7	100.0

of $10 million in assessed valuation, Missouri counties showed a general pattern of increased computer use (Table 23). Almost all of Missouri counties (89 percent) with an assessed valuation of more than $40 million had some kind of computer hardware of their own in place by 1982 (Table 23).

Counties were also evaluated in the four states in term of the relation between population and computer use. Population class intervals in increments of 10,000 were examined relative to computer hardware in place up to 50,000 population. All counties with more than 50,000 were grouped as one because almost all counties with more than 50,000 population in all four states had their own computer hardware in place. The major exceptions to this were two Michigan counties with large population and assessed valuation that were using computer services in lieu of their own computers for data storage and processing (use of computer service does not show in this tabulation).

Table 23. Relation between population and computers in Iowa counties

Population	Number of counties	Number of computers	Percent total with computers
0-10,000	15	7	46.7
10,001-20,000	46	41	41.4
20,001-30,000	18	16	88.9
30,001-40,000	3	3	100.0
40,001-50,000	7	6	85.7
Over 50,000	10	9	90.0

Counties with 20,000 or fewer people were the only county population grouping with relative low percentages of counties in the group with their own computer hardware (Tables 24, 25, and 26). Even so almost 50 percent of Missouri and Iowa counties with population up to 10,000 had their own computers (Tables 24, 25, and 26).

In summary, most counties in the four states with more than 10,000 people and more than $50 million in assessed valuation had their own computers or were renting a computer service. Even smaller counties in terms of population and assessed valuation substantial numbers were successfully using computers or computer services for at least part of the county government functions.

Central Data Base

In 1963, Hearle and Mason developed the concept of a generalized unified information system for state and local governments. The key idea of this prototype system was the organization of data utilized by state and local government on the basis of type of data use rather than being organized around function of office as has been traditional in state and local government. Central to the idea of the unified information system conceived by Hearle and Mason was the division of data into two major categories. These categories were environmental and internal. Environmental data conceptually consisted of real property, personal property, and personnel data and such data are generated external to government but

Table 24. Relations between population and computers in Kansas counties

Population	Number of counties	Number of computers	Percent total with computers
0-10,000	60	6	10.0
10,001-20,000	17	3	17.6
20,001-30,000	11	6	54.5
30,001-40,000	5	4	80.0
40,001-50,000	3	3	100.0
Over 50,000	10	8	80.0

Table 25. Relation between population and computers in Michigan counties

Population	Number of counties	Number of computers	Percent total with computers
0-10,000	11	1	9.1
10,001-20,000	16	5	31.2
20,001-30,000	11	4	36.4
30,001-40,000	6	2	33.3
40,001-50,000	7	2	28.6
Over 50,000	31	24	77.4

Table 26. Relations between population and computers in Missouri counties

Population	Number of counties	Number of computers	Percent total with computers
0-10,000	26	10	38.5
10,001-20,000	43	29	67.4
20,001-30,000	21	18	85.7
30,001-40,000	7	6	85.7
40,001-50,000	4	3	75.0
Over 50,000	13	12	92.3

are heavily utilized by almost all counties offices for performing various functions connected with specific county offices. In contrast, internal data conceptually would consist of local government financial and internal accounting function and would be concerned with data generated by the local government itself.

Hearle and Mason visualized the unified information system's major improvement over traditional methods as reducing or eliminating overlapping data collection, storage, and processing believed to exist in conventional manually oriented local government data record systems. Eventually, these investigators visualized a unified information center which would store ll environmental and internal data necessary for performance of all city, county, and state governmental functions.

Herle and Mason perceived the involvement of the unified information system developing first at the local government level. For example, county governments were expected to first centralize their record keeping and data processing centrally around the dichotomy of environmental and internal data. Each county office would then have access to the central data base for performing their individual function. Eventually as information technology developed a centralized information center was to evolve in which all local and state government data would be stored and instantaneously accessible to all functional units of government having need for access.

The major advantages of such a system as perceived by Hearle and Mason then would be: (1) reducing duplication in data collection, storage, and processing and (2) increasing accessibility and usefulness of data. Two major benefits were expected. These were to: (1) lower cost in information handling and (2) improve the management decisionmaking of participating units of government.

The idea of a unified information system appeared to be a theoretically valid concept which should have advantages to local governments that were visualized by Hearle and Mason in their 1963 study. In addition, more than adequate technology has since been developed which would make such a system appear to be both possible and practical.

Given the concepts which have been related, a small part of this study was concerned with trying to determine whether county government were viewing their data storage and processing needs from an overall standpoint rather than from the conventional functional standpoint.

Respondents were asked to what extent the county had moved toward the concept of a central or unified data base. It was soon obvious to the interviewer that the idea of such a central data base was an idea whose time had not come. Only six Iowa counties had a serious thrust toward such a system. For Kansas, Michigan, and Missouri the numbers of counties were 2, 7, and 6 respectively. Only larger counties have made serious thrusts toward centralization of their data bases. No movement was detected in any of the four states toward a centralized information system visualized by Herle and Mason.

Computer Language Used by County Governments

In the planning phases of the study the computer language used by individual county governments was deemed to be an important question. This was true primarily because it was assumed that predominant use of a particular language might facilitate the exchange of software developed by individual counties using the same computer language. Actually, there appear to be several technical limitations associated with the sharing of software on different brands using the same language and even some problems with different models of some brands. Thus, the issue of computer language used by counties is less important than originally visualized with the current state of technology.

Actually, a majority of the persons interviewed in counties with computers did not know the language being utilized (Table 27). This is not an indictment or criticism because most respondents were elected county officials with much broader responsibilities than data processing. As previously reported, many counties depended on private service firms or their computer supplier for software and this could not be expected to be concerned with such a technicality. Nevertheless, those counties large enough to have a data processing professional did know the language utilized. The predominant languages in such systems were COBOL and RPG2 (Table 27).

Table 27. Computer language used in county government systems in the four states

States	Cabol		Fortran		PL1		RPG_2		Other		Did not know	
	No.	Percent* of total counties w/c	No.	Percent* of total counties w/c	No.	Percent* of total counties w/c	No.	Percent* of total counties w/c	No.	Percent* of total counties w/c	No.	Percent* of total counties w/c
Iowa	13	15.8	0	0.0	0	0.0	12	14.6	5	6.1	52	63.4
Kansas	4	14.3	0	0.0	1	3.6	1	3.6	3	10.7	21	75.0
Michigan	14	35.0	0	0.0	0	0.0	9	22.5	3	7.5	14	3.50
Missouri	7	9.1	1	1.3	0	0.0	3	3.9	1	1.3	66	85.7

*w/c is with computers

Propensity to Purchase Computers

Counties that did not have computers were asked about possible future purchasing plans. In some cases, counties with computers indicated plans to change or update their computers. These responses were also recorded as positive response.

County plans were also evaluated in terms of reason for not purchasing computer equipment and these results are summarized in Table 28. All states had some counties reporting intentions to purchase computers. Kansas had 20 counties reporting plans to purchase new computers in the next year (Table 28). Those reporting no plans to purchase were mostly counties without computers but a few responses were also from counties that wanted to update their computer systems. Lack of money and county too small to make practical use of a computer were reasons that were given for not purchasing a new computer or updating. Thirty-nine Missouri counties indicated financial problems to purchase a new computer or in updating an old one.

Special Topics and Considerations

In addition to formal questions which were asked in the survey, respondents were asked to add any comments that they might want to make. By this procedure it was thought that some problems or issues might be delineated that would otherwise not be uncovered. Impressions picked up by the interviewer (investigator) in this process cannot be regarded as scientific in the sense of being tabulated from a formal response to a

Table 28. Purchasing plans for computers in counties in the four states

State	Planning to purchase		Reason for not purchasing	
	Number	Percent of total counties	Lack of money	County too small not practical
Iowa	5	5.0	0	0
Kansas	20	19.6	5	7
Michigan	8	9.6	1	4
Missouri	19	16.6	39	2

formal question. Yet the comments appeared to have some general validity and are thus deemed worth noting even though a tabulation of the population or estimation of generality cannot be made.

With a few glaring exceptions, "off the cuff" responses of respondents indicated general satisfaction with both computer hardware and software in use. Only one "horror" story was recorded out of the 400 responding counties. In that particular case, the county had purchased a computer in the late 1970s and as of April 1982 still had not managed to get it programmed to perform any county government function. Sizable minorities of respondents in counties in all states did report less than optimum satisfaction with software currently in use. A smaller minority were not totally pleased with existing hardware.

A fairly common "off the cuff" response from professional data processing respondents in all states was an expressed need for standardization of data processing procedures and computer software

across counties in a particular state. Most of these responses implied a need for state governments to beome involved in the process of developing data processing standards for county governments.

Another fairly common expression of concern was getting and keeping a good programmer. This concern seemed to be most prevalent in smaller counties that were using private service firms for software development.

Some comments expressed concern about unemployment that might be a result of automating county data processing. One respondent believed that it was not practical to replace $1,000 dollars per year of clerical help with a $40,000 computer. Another using a private firm for tax work indicated a cost of $12,000 per year for such service. A county computer to perform this service internally was believed to cost about $60,000 and was thus not considered a good investment.

In Missouri and Kansas, many county respondents indicated that they had purchased a computer or would purchase one soon because of the extra paper work associated with reassessment. Concern was also expressed about the lack of software needed for the reassessment that had been mandated by state law.

A fairly common comment was that "off the shelf" packaged financial software did not fit county government needs. It needed either major modifications or in many cases could not be modified even at considerable expense to meet county needs. Many times respondents gave the general

impression that computers were not being fully utilized because of software limitations. This, of course, was supported in a more scientific manner in the section on functional applications.

Some strong impressions of brand allegiance were given particular to the big three computer vendors (Burroughs, IBM, and NCR). Specific reasons for brand allegiance were meager although a few were given. Several respondents commented that software packages are difficult to develop for county government because each county wants to do things its own way, i.e., a little differently than the next county.

Several respondents in each state mentioned the trauma of making the transfer from manual to computer data processing. A common time for making the transition appeared to be one to two years. Although all states except Iowa report substantial use of private computer service for data processing, almost all counties using a data processing service expressed a desire or left the impression that they deemed it desirable to have a computer of their own. This appeared to be true even for those counties that were very well pleased with their data processing service.

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